

# ***Multipoint Geospace Science in 3D: The Paired Ionosphere-Thermosphere Orbiters (PITO) Mission***

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The science enabled by the Paired Ionosphere-Thermosphere Orbiters (PITO) mission is described and discussed. PITO has been designed to provide the concurrent, three-dimensional, multipoint measurements needed to advance geospace science while staying within a stringent resource envelope. The mission utilizes a pair of orbiting vehicles in eccentric, high-inclination, coplanar orbits. The orbits have arguments of perigee that differ by 180 degrees and are phased such that one vehicle is at perigee (~200 km) while the second is at apogee (~2000 km). Half an orbit later, the vehicles switch positions. Three complementary types of measurements exploit this scenario: local, *in-situ* measurements on both satellites, two-dimensional imaging from the higher satellite, and vertical sounders. The main idea is that two-dimensional context information for the low-altitude measurements is obtained by the high-altitude imagers, while information on the third dimension is provided by vertical profiling. Such an observation system is capable of providing elements of global coverage, regional coverage, and concurrent coverage in three dimensions. Science goals are presented, as are the results of a detailed implementation plan, including several trade studies on key elements of the mission. The conclusion is that the mission would enable significant new understanding of the ionosphere-thermosphere system within a resource envelope that is consistent with that of NASA's Medium Explorer (MIDEX) line of science missions.